Jan. 5, 1932. W. C. GROENIGER ET AL 1,839,962

VALVE

Filed June 2, 1928

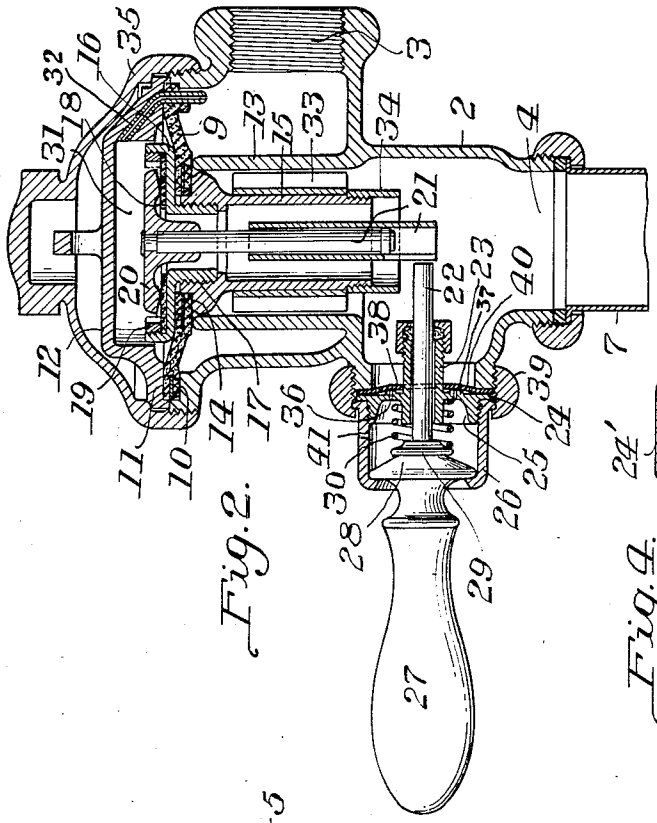


Fig. 2.

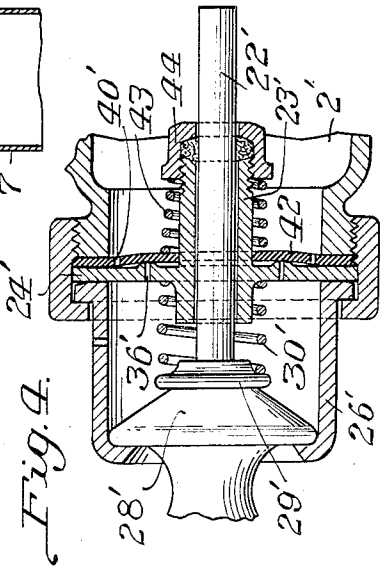


Fig. 4.

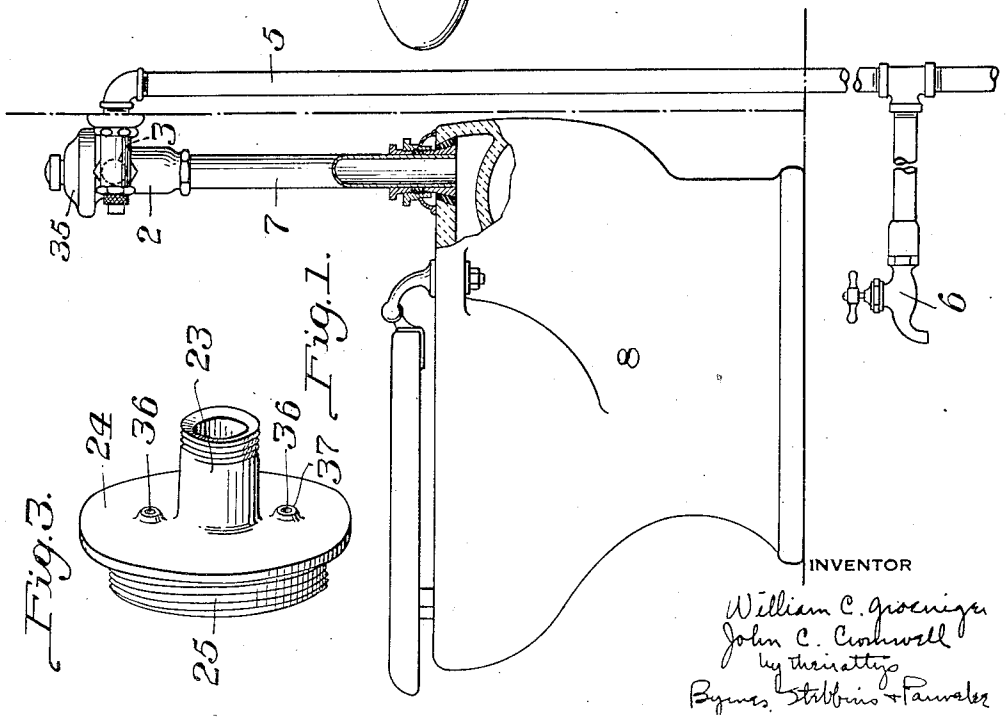


Fig. 1.

Fig. 3.

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Patented Jan. 5, 1932 1,839,962

UNITED STATES PATENT OFFICE

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VALVE

Application filed June 2, 1928. Serial No. 282,344.

The present invention relates broadly to the art of water distribution and more particularly to improved valves for use in connection therewith. At the present time, there is a growing tendency in the art to which the present invention relates to provide plumbing systems of the character utilized for controlling the supply of water to waste receptacles, such for example, as closets, urinals and the like, with so-called flushometer valves. Such valves are ordinarily of a construction insuring automatic closing of the valve within a time interval regulable at will. Systems embodying such valves, irrespective of the specific valve structure, are of four general types, the present invention being equally well adapted for use in any of these different types. All of these above systems are adaptable for use with valves of the same construction, the differences being merely with respect to the point of connection of the system to the waste receptacle and the location of the valve relatively to such point of connection. In all of these systems, it is necessary to provide a continuously open water supply connection to the valve and a continuous connection from the valve to the waste receptacle, the flow of water from the inlet to the outlet being controlled by the pressure conditions within the system, but the arrangement being such that at any given time the flow of water may be started.

In all of the above systems, we have found that the construction of the valve parts required to prevent leakage of water from the system has resulted in air-tight connections, such that under certain conditions of operation, the valve constitutes part of a siphon system permitting actual siphoning of the contents of the waste receptacle into the source of water supply.

In many States, legislation has been enacted having for its purpose the prevention of the use of any system or valve by means of which such a condition can be created as will permit such back flow of water and consequent pollution of the water supply. The standard valves commonly in use have heretofore been considered as effectively preventing the possibility of pollution under any conditions of operation, but by a series of experiments, we have conclusively determined that under different conditions, such a siphoning operation can take place. Such condition may be caused, for example, where the waste receptacle becomes clogged, preventing discharge therefrom with a consequent rise in the water level therein, accompanied by a temporary cutting off of the supply of water and drainage of the water supply system. The draining of the supply water serves to create a vacuum effective for lifting the contents of the waste receptacle upwardly through the valve and thence downwardly into the water system.

The present invention has for one of its objects to provide a valve of such construction that the possibility of an objectionable operation of the character referred to is precluded.

Another object of the present invention is to provide a replacement part for valves of standard construction adapted to be substituted for other parts of the valve and effective automatically for preventing an operation of the character referred to.

Still another object of the invention is to provide a combination valve and vacuum-breaking means, the construction being such that accidental leakage from the valve is prevented, while the flow of air into the valve under predetermined conditions of operation is insured.

In the accompanying drawings, we have shown for purposes of illustration only, certain preferred embodiments of the present invention, it being understood that the drawings do not define the limits of our invention, and changes in the construction and arrangement of the parts may be made without departing from the spirit or scope of our broader claims.

In the drawings:

Figure 1 is a diagrammatic view showing the use of a valve constructed in accordance with the present invention;

Figure 2 is a sectional view through the valve;

Figure 3 is a perspective view, on an en-

larged scale, illustrating a portion of the vacuum-breaking assembly; and

Figure 4 is a detail sectional view on an enlarged scale illustrating a modified embodiment of the present invention.

In carrying out the present invention, there may be provided a valve casing 2 of any desired construction having a suitable inlet connection 3 and an outlet connection 4. The inlet connection 3 communicates with a water supply line 5 of standard construction, having, for example, a point of water offtake 6 in the form of the usual faucet. The outlet 4 has a closet connection 7, leading to the waste receptacle to be flushed, such receptacle herein being illustrated as comprising a bowl 8 of standard construction.

Under conditions of normal operation, the flow of flushing water from the inlet to the outlet is prevented by a diaphragm valve 9 of suitable construction, clamped at its outer edge between a suitable shoulder 10 on the valve casing and a flange 11 on a cap 12. At its inner edge, it is adapted to seat on the outer end of a tubular extension 13 within the valve, the extreme inner edge being clamped between a shoulder 14 on a sleeve 15, and the lower surface of the clamping collar 16 having a suitable threaded connection 17 with the sleeve.

The clamping collar 16 is, in turn, shaped to provide a seat for a gasket 18, which may be held in any desired position, as for example, by the provision of a clamping ring 19. Cooperating with the gasket 18 is a valve 20, having a stem 21, adapted to be engaged by the inner end of a trip rod 22. The trip rod is slidingly mounted within the tubular guiding portion 23 of a removable assembly, including a flange 24, projecting outwardly from the guiding portion 23 and having an exteriorly threaded cup-shaped portion 25 on one face thereof. The cup-shaped portion 25 is adapted to be threaded into a cam housing 26, shaped to cooperate with an operating handle 27, carrying an operating cam 28, in engagement with the head 29 on the rod 22. Interposed between the head 29 and the assembly referred to is a spring 30, normally urging the rod 22 into the position illustrated in Figure 1.

Upon operation of the handle by moving the same either inwardly or in any angular direction with respect to its full line position, the cam 28 is effective against the head 29 for moving the rod 22 to the right, as viewed in the drawings, whereby it is brought into engagement with the lower end of the stem 21 for unseating the valve 20. This permits the water within the chamber 31 below the cap 12 to discharge therefrom, whereupon the water pressure through the inlet connection is effective against the under side of the diaphragm 9 for raising the same and establishing a flow between the inlet and outlet. This flow continues until such time as a sufficient amount of water passes from the inlet through the passageway 32 to the chamber 31, above the valve, to build up a pressure effective, by reason of the greater area exposed thereto, to force the diaphragm downwardly into the position shown in the drawings. The sleeve 15 may be guided in its movement by a spider guide 33, carried thereby and held in position by a retaining ring 34, threaded on to the lower end of the sleeve. The inner cap 12 may also be held in position by a suitable closure 35, threaded into position on the valve casing.

With the construction described, it will be seen that, in the event the lower end of the connection 7 is submerged or is hermetically sealed against the inlet of air under such conditions that liquid may be supplied to the lower end thereof and a vacuum created in the supply line 5, such as would occur with the water shut off and the offtake 6 open; a siphoning action would be created effective for unseating the diaphragm 9 and raising waste water upwardly through the connection 7 past the valve and into the water supply system. In order to preclude the possibility of such an operation, we provide the flange 24 with one or more openings 36 extending therethrough, each of which openings is preferably surrounded at its inner end by a raised seat 37. Cooperating with such openings in the form illustrated in Figures 1 and 2 is a flexible valve 38 which may be of rubber, leather or other suitable material. This valve may be constructed of such dimensions as to constitute a gasket effective upon the tightening of the clamping ring 39 for preventing leakage between the flange 24 and the casing 2. Preferably formed in the valve 38 at such points as to be offset relatively to any opening or openings 36 are openings 40.

With the construction described, it will be apparent that the valve 38 will normally be effective for closing the openings 36 to prevent accidental leakage from the valve outwardly. In the event, however, of the production of lowered pressure within the valve casing, the valve will immediately move inwardly from the seats 37, permitting a flow of air from the atmosphere to the interior of the valve, whereby the vacuum therein will be broken and the creation of a siphoning action prevented. If desired, the housing 26 may be provided with a suitable opening 41 therethrough, insuring the free flow of air to the opening or openings 36.

Inasmuch as the assembly comprising the guide 23, the flange 24 and the exteriorly threaded projection 25 constitutes a standard part of present day installations, it will be apparent that our invention may be readily applied to existing systems by the removal of the standard assemblies therefrom and the

substitution therein of the vacuum-breaking assembly. This greatly increases the value of the invention, making it applicable not only to include installations, but also to existing structures.

While we have herein illustrated the vacuum-breaking assembly as applied to the valve at a particular point by reason of the fact that such a location permits ready application of the invention to structures now in use, it will be apparent to those skilled in the art that our invention is not limited with respect to the location of the vacuum-breaking means, it being merely necessary to provide such means intermediate the waste receptacle 8 and the point of offtake 6. It is one of the objects of the present invention, however, to provide a combined valve and vacuum-breaking means adapted to automatically operate to prevent the objectionable conditions referred to, merely by the act of connecting the same in any system embodying a bowl or other waste receptacle, a flushometer valve, and suitable inlet and outlet connections thereto and therefrom.

In Figure 3 of the drawings, there is illustrated a slightly modified embodiment of the invention, in which parts corresponding to parts already described are designated by the same reference characters, having a prime affixed thereto. In this form of the invention, the flange 24′ is provided with a similar opening or openings 36′, which openings are adapted to cooperate in the modified embodiment with a disk valve 42, normally urged into sealing position in any desired manner, as for example, by a compression spring 43, bearing at its inner end against a disk valve and at its outer end against the packing gland 44 for the trip rod 22′. With such construction, the sealing valve is positively urged into position to close the openings 36′ under conditions of normal operation, whereby leakage through such openings is precluded.

In our copending application, Serial No. 282,343, filed June 2, 1928, we have claimed a system of the general character herein shown, effective for preventing pollution of a water supply; and the present application is directed particularly to a valve construction effective in such a system and providing a unitary structure constituting both a controlling mechanism for the water and for the pressure conditions. This constitutes one of the advantages of the present invention.

Other advantages of the invention arise from the provision of a combined controlling valve and vacuum breaker adapted for use in plumbing systems.

Still another advantage of the present invention arises from the provision of a vacuum-breaking means comprising an assembly adapted to be substituted bodily for standard assemblies in present valve structures, and thereby so converting such structures as to preclude possibility of water contamination by the use thereof.

We claim:

1. In a fluid system, the combination with a tubular member for guiding a valve actuating rod penetrating a valve casing, said member having a flange, and a vent in said flange provided with a raised seat at the inner end thereof, of a flexible diaphragm cooperating with said flange to admit air through said vent on the occurrence of a vacuum in the casing.

2. In a fluid system, the combination with a tubular member for guiding a reciprocating valve actuating rod penetrating a wall of a valve casing, a flange on said member having vent holes therein, and a raised rim around the inner end of said vent hole, of a flexible diaphragm disposed on said member and adapted normally to engage said raised rim to seal said vent.

3. The combination with a valve casing, a guide for a valve actuating rod having a flange for seating over an opening in said casing, and a hole in said flange having a raised inner edge, of a resilient diaphragm surrounding said guide and normally contracted to close said hole by engaging said raised edge.

4. The combination with a valve casing, a valve actuating rod projecting through a tubular guide in the wall of said casing, said guide having a flange, a vent in said flange having a raised seat at the inner end thereof, of a resilient diaphragm normally covering said flange for firm engagement with said seat.

In testimony whereof we have hereunto set our hands.

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